

1 IAP13 Rec'd PCT/PTO 08 DEC 2005

**Device for connecting a wheel axle housing with the chassis of a vehicle**

The invention relates to a device for the connection of a wheel axle housing with the chassis of a vehicle comprising

-a stabilizer with

a rod-shaped torsion element that is mounted such that it can rotate around its lengthwise axis,

two first arms, positioned across said torsion element, said first arms having first end portions that are rigidly attached to corresponding end portions of said torsion element, and two second arms (drop links), whose first end portions are articulatedly connected with the second end portions of the first arms, such that the arms extend at an angle in relation to the lengthwise axis of the torsion element, and further comprising

-a spring/suspension element comprising at least one spring/suspension member having a first member that is connected to the wheel axle housing, and a second member that is connected to the chassis, such that said member are capable of reciprocal resilient movement.

A device of this type is common for vehicles and can be employed with front axles as well as back axles. Hereunder it is known that the torsion element's housing is attached to the wheel axle and that the torsion element runs along this. If the device is used for example with a back axle, the first arms normally run horizontally backwards from the torsion element, and the second arms extend vertically upwards, such that the second arms' upper end sections are connected with corresponding side portions of the chassis above and behind the wheel axle.

A disadvantage of such a device is that it occupies space in the vehicle behind the wheel axle and contributes to a greater length of the vehicle. In addition, because of the fact that the heavy torsion element and partly the first arms move together with the wheel axle, the mass of the vehicle not supported by the spring/suspension device will be great, something which negatively affects the vehicle's driving performance.

According to the prior art, the spring/suspension element can comprise for example four spring/suspension members that are attached in pairs to two horizontal yokes that are attached to and run crosswise to the wheel axle. These yokes are also heavy and contribute to the mass of the vehicle not supported by the spring/suspension device being great.

It is known from the prior art that it is normal for a back axle to be connected to the chassis by a so-called V-rod that maintains the back axle sideways in relation to the chassis, and two reaction rods that prevent a rotation of the back axle along the vertical axis of the vehicle. If the back axle moves in a vertical direction in relation to the chassis at the same time that the vehicle tilts, the result can be a mutual sideways movement of the end portions of the spring/suspension elements, which have resulted in an increased strain on the spring/suspension elements reducing their lifetime.

With vehicles having a plurality of front wheel axels and/or back wheel axels, it is known from the prior art that one or more of these can be lifted such that the corresponding wheel does not touch the ground. To achieve this, there is arranged in the chassis a support member or bridge that runs crossways in relation to the length of the vehicle, and that near the midsection of the wheel axle carries a special lifting actuator. The separate bridge and actuator contribute to increasing the weight of the vehicle, the production time and the price.

The object of the invention is to provide a device of the type described above that is to a lesser degree affected by the above-described disadvantages.

The characteristic features of the device according to the invention are specified in the claims.

The invention will be described in more detail below with reference to the figures that show embodiments of the device according to the invention.

Fig 1 is perspective view of a rear portion of a vehicle, seen from below and from the back, wherein obscuring portions have been omitted.

Fig 2 is a longitudinal section through the device according to the invention, wherein obscuring portions have been omitted.

Fig 3 is a longitudinal section similar to that shown in fig 2, but showing a different embodiment of the invention.

In fig 1 and 2 is shown two frame beams 1, 2 of a chassis of a vehicle and a rear axle housing 3, which is located under frame beams 1, 2, wherein these frame beams hereafter shall represent the chassis. Running in front of and over back axle housing 3 in the crossways direction of the vehicle is a rod shaped torsion element 4 of a stabilizer 5. Torsion element 4 is arranged in the chassis such that it can rotate along its longitudinal axis 6.

Horizontally and behind torsion element 4 run two first arms 11,12 whose first end portions 13,14 are rigidly attached to corresponding end portions 7, 8 of torsion element 4. Second end portions 15,16 of the first arms 11,12 are articulatedly attached with corresponding first end portions 23,24 of two vertically, downwardly projecting second arms 21,22 (drop links) via shaft extensions 51,52 that extend in the crossways direction of the vehicle, and that are shown only by indicating the longitudinal axis of such shaft extensions. Second end portions 25,26 of the second arms 21,22 are articulatedly connected with back axle housing 3 via shaft extensions 53,54 that extend in the crossways direction of the vehicle, and that are likewise only shown by indicating the longitudinal axis of such shaft extensions.

The torsion element's end portions 7, 8 are also rigidly connected with corresponding, first end portions 33, 34 of two third arms 31, 32, that preferably extend at an angle

downward and forward. Second end portions 35,36 of the third arms 31,32 are articulatedly connected with two corresponding first end portions 43,44 of two press rods or fourth arms 41,42 of two spring/suspension elements 61,62 via corresponding axels 55, which are shown only by indicating the axle's longitudinal axis.

As shown in fig 2 and 3, press rod's second end portions 45,46 are fixedly attached to a corresponding outer housing 63 of spring elements 61,62. These housings 63 and have a bottom 65 and a cylindrical sidewall 66 and an opening 67 on the opposite side of bottom 65. The fourth arms 41,42 extend through the corresponding openings 67 and are fixedly attached with the portion of bottom 65 directed in towards the interior of housing 63,64.

A piston-like head 68 is slidably and sealingly arranged in outer housing 63 and is introduced in the housing via opening 67. Head 68 is connected to the chassis via a shaft extension 56 that runs parallel with shaft extension 55. Alternatively, axle extension 56 may have a spherical surface that permits the swinging of head 68 also about an axis that runs perpendicular to the longitudinal axis of the fourth arms 41,42. Within head 68 is provided an axial bore 69, where through run the corresponding, fourth arms 41, 42, such arms being sealingly arranged and displaceable in their lengthwise direction in relation to housing 63 i.e. either slidable or with clearing. A seal can be achieved by the help of a membrane 60 that is attached to both housing 63 and head 68, such that a portion of membrane 60 runs along the inside of housing wall 66 and another portion of the membrane runs along the outside of the outer surface of head 68. Between these two portions, the membrane has a folded portion. Membrane 60 defines a first pressure chamber 70.

This embodiment of the device according to the invention functions as described below.

When the chassis exerts a load on wheel axle housing 3, and for the sake of simplicity is assumed that the chassis does not tilt in relation to the wheel axle housing, then the chassis will as a result be lowered in relation to wheel axle housing 3. Thereby, torsion element 4 will be rotated in relation to the chassis, in that the first arms will be swung in a counterclockwise direction as shown in fig 3 because of these arms' connection with wheel axle housing 3 via the second arms 21,22.

Because torsion element 4 is however also connected with the third arms 31,32 and also attempt to rotate these in a counterclockwise direction, then these third arms will attempt to draw the fourth arms 41,42 and the housing 63,64 towards the right as shown in fig 3. Because head 68 however is connected with the chassis via axle extension 56, the volume of pressure chamber 70 will be reduced, whereby the pressure of the gas in pressure chamber 70 will be increased and exert a force that attempts to press housings 63 and the arms in the opposite directions. This pressure thereby creates an opposing force that prevents a further lowering of the chassis in relation to the wheel axle housing 3.

The vertical arrangement of the second arms 21,22 and the arrangement of the spring/suspension elements 61,62 that are connected to torsion element 4 via the third and the fourth arms 31,32 and 41,42 respectively, creates a minimally space-demanding,

inexpensive and simple spring/suspension of wheel axle housing 3 in the vehicle. The arrangement of the torsion element and the spring/suspension elements on the side of the wheel axle housing that is directed towards the vehicle's midsection, seen from the vehicle's lengthwise direction, allows for a reduction in the length of the vehicle.

In either housing 61,62 or head 68 there can be provided a channel 71 that by way of a valve 72 can be arranged to be connected to a pressurized gas source 73, that in the event of a gas leakage from pressure chamber 70 can be filled with gas. In the alternative, the ground clearance of the vehicle's chassis can be set.

The spring/suspension elements thereby function as a simple pressure fluid actuator.

The device can be used in a simple matter for raising of the wheel axle housing. For this purpose, as shown in fig 3, head 68 can for example be provided with an extension of boring 69, wherein this extension is concentric in relation to bore 69 and forms a cylinder 80. The fourth rod 41,42 is hereby provided with a flange that forms a piston 81 that is arranged to sealingly glide in cylinder 80 in that piston 81 is provided with a gasket 82. Cylinder 80 has a bottom 83 and near bottom 83 the head carries a gasket 84 that creates a seal between the fourth rod 41,42 and boring 69 in head 68. The bottom 83, cylinder 80 and piston 81 defines a second pressure gas chamber 85, and there is arranged in head 68 a channel 86 that is designed to connect chamber 85 with pressurized gas source 73 by way of a valve 87. It should be understood that the channel can alternatively be provided in the housing and/or the fourth arm 41.

By the introduction of pressurized gas in the second chamber 85 and the possible release of gas from the first chamber 70, the fourth arms 41,42 can be moved to the right as shown in fig 4 and the first, second and third arms as well as the torsion element can be swung counterclockwise and the wheel axle housing thereby raised in relation to the chassis until the wheels touch the ground, in that the chassis will then be supported by the remaining wheel axles.

It can thus be seen that the invention provides a very compact, inexpensive and simple multifunction device for supporting a wheel axle housing in a vehicle.

## PATENT CLAIMS

1. A device for connecting a wheel axle housing (3) with a chassis (1, 2) of a vehicle, comprising
  - a stabilizer (5) having
  - a rod shaped torsion element (4) that is arranged such that it can rotate along its longitudinal axis (6),
  - two first arms (11, 12) running in a crosswise direction in relation to torsion element (4) having first end portions (13,14) that are rigidly attached to corresponding end portions of torsion element (4), and
  - two second arms (drop links) (21,22), whose first end portions (23,24) are articulatedly attached to the second end portions (15,16) of the first arms (11,12), whereby the arms (11, 12, 21, 22) extend at an angle in relation to the longitudinal axis (6) of torsion element (4) and further comprising
  - at least two spring/suspension elements (61,62) with a first member (63) that is connected with the wheel axle housing (3), and the second member (68) that is connected to the chassis (1, 2), whereby members (63,68) are arranged for reciprocal resilient movement and to transfer a portion of the chassis' weight to the wheel axle housing (3),
  - characterized in that
    - torsion element (4) is mounted in the chassis (1, 2),
    - the second end portion (25,26) of the second arms (21,22) are connected to the wheel axle housing (3) and extend essentially vertically up therefrom, and
    - the spring/suspension elements have corresponding third arms (31,32) having first end portions (33,34) that are rigidly attached to the corresponding end portions (7, 8) of torsion element (4), and second end portions (35,36) that are connected with the first member (63).
2. The device according to claim 1 wherein the wheel axle housing (3) is arranged to be raised such that the corresponding wheel does not touch the ground, whereby members (63, 68) of the spring/suspension elements in a first direction in relation to each other, characterized in that the spring/suspension elements comprise force exerting means (81) that are arranged to move the members reciprocally in the first direction.
3. The device according to claim 2, characterized in that the two members (63,68) of the spring/suspension elements (61,62) define a pressure gas chamber (85) and the force exerting means comprise a channel (86) that is arranged in one of the members (63,68), and that is arranged to connect pressure gas chamber (85) with a pressurized gas source (73), whereby an increase of the gas pressure in pressure gas chamber (73) causes a reciprocal movement of the members (63,68) in the first direction.
4. The device according to one of the preceding claims,

characterized in that torsion element (4) is arranged on the side of wheel axle housing (3) that is directed towards the vehicle's midsection, seen in the vehicle's lengthwise direction.

5. The device according to one of the preceding claims, characterized in that the second member (68) is articulatedly connected with the chassis (1, 2).
6. The device according to one of the preceding claims, characterized in that the spring/suspension connection between the members (63,68) is achieved in that said members define a pressure gas chamber (70), whereby an increase in the weight of the chassis (1, 2) results in a reduction of the volume of pressure gas chamber (70) and an increase in the pressure of the pressure gas.
7. The device according to claim 6, characterized in that a membrane (60) that defines pressure chamber (70) is arranged between the two members (63,68).

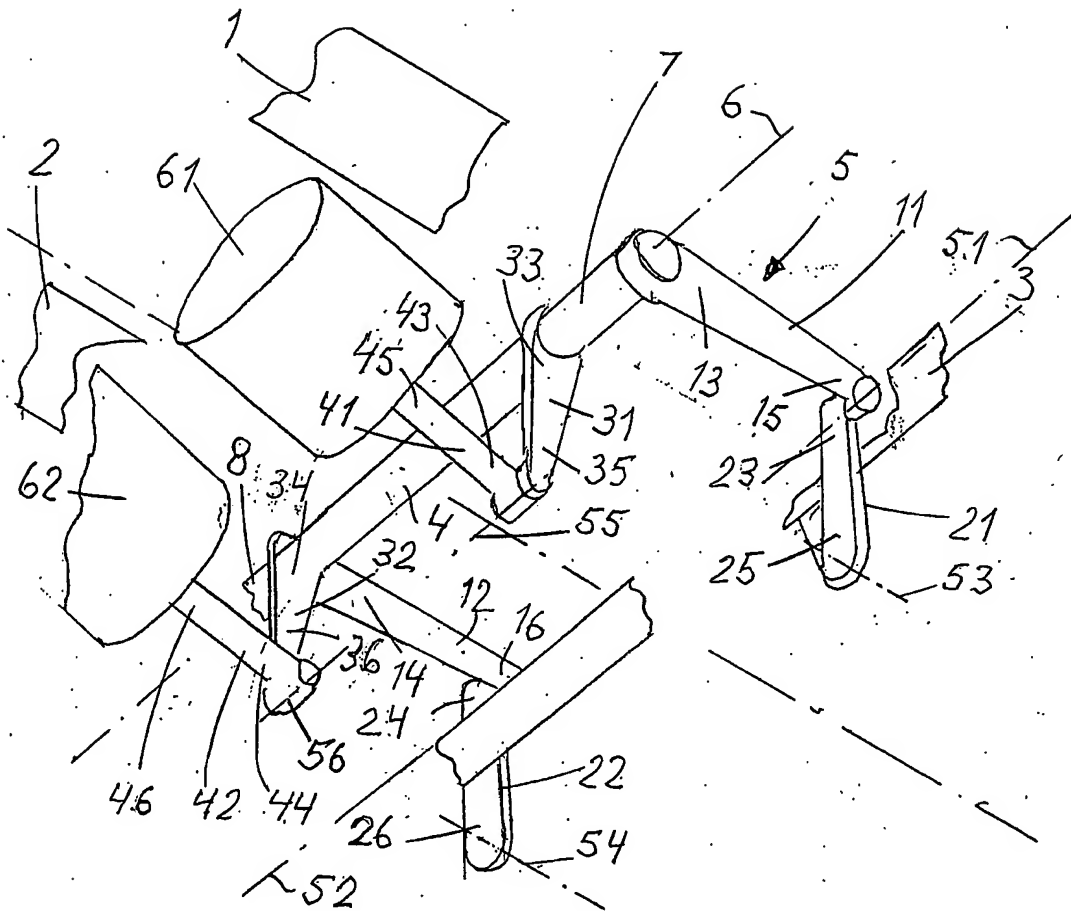
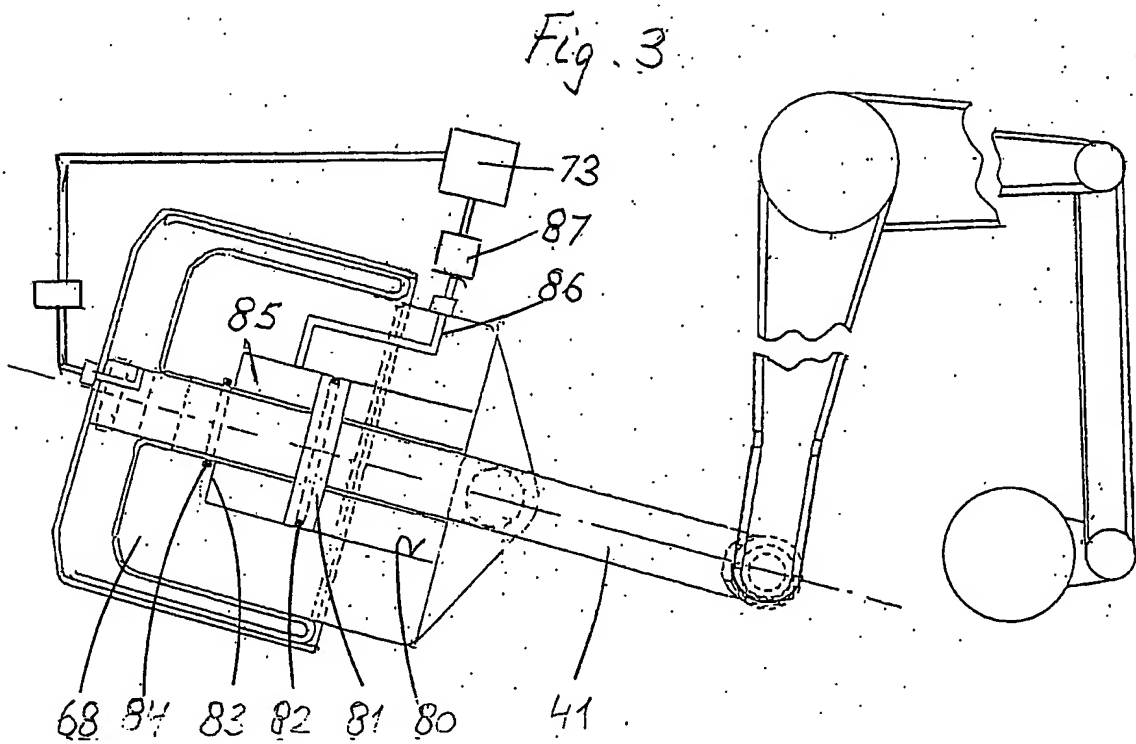
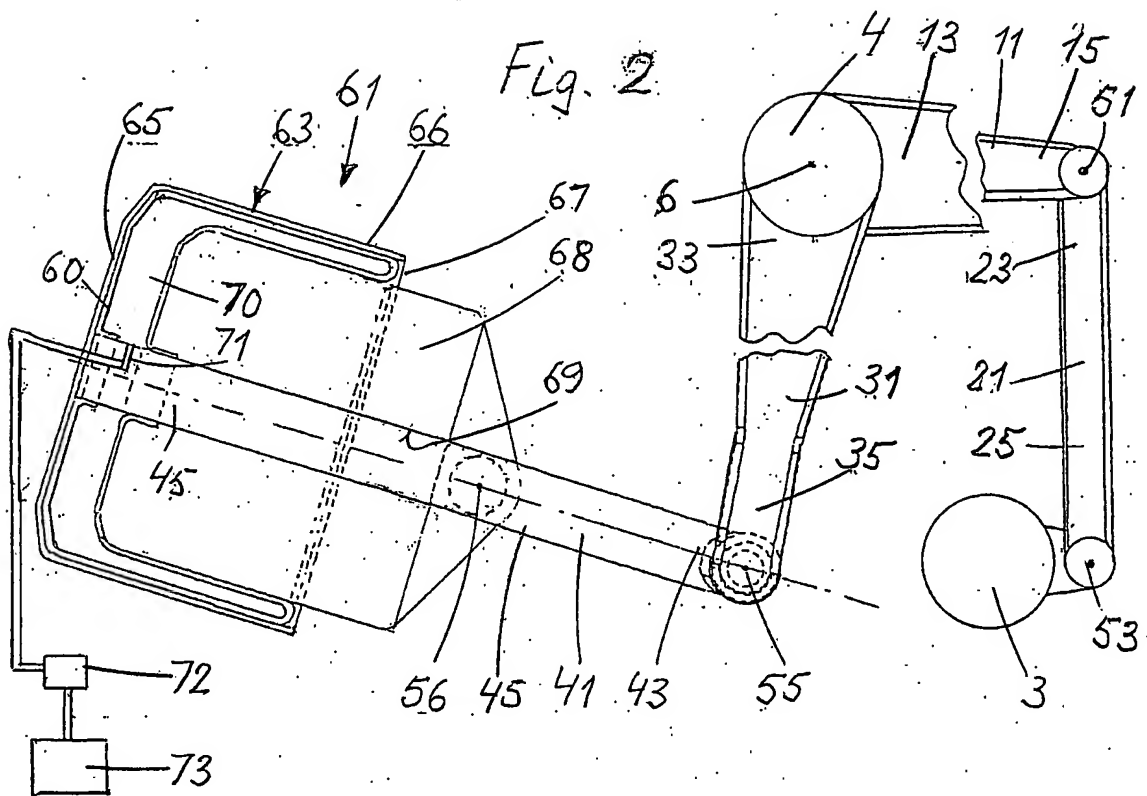


Fig. 1





# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/N02004/000165

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B60G21/055 B62D61/12 B60G11/64 B60G21/05

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B60G B62D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 302 417 B1 (HEYRING CHRISTOPHER B) 16 October 2001 (2001-10-16)	1
Y	column 17, line 35 - column 18, line 15; figures 8-10	2,3
Y	FR 1 299 215 A (MASCHF AUGSBURG NUERNBERG AG) 20 July 1962 (1962-07-20) page 2, left-hand column, paragraph 3 - right-hand column, paragraph 1; figures 1,2	2,3
Y	US 2001/022432 A1 (HEBERT MARC) 20 September 2001 (2001-09-20) paragraph '0061! - paragraph '0062!; figures 5,7,11	1,4-7
	----- -/--	



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

\* Special categories of cited documents:

\*A\* document defining the general state of the art which is not considered to be of particular relevance

\*E\* earlier document but published on or after the international filing date

\*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

\*O\* document referring to an oral disclosure, use, exhibition or other means

\*P\* document published prior to the international filing date but later than the priority date claimed

\*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

\*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

\*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

\*G\* document member of the same patent family

Date of the actual completion of the international search

29 September 2004

Date of mailing of the international search report

07/10/2004

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Torsius, A

# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/N02004/000165

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 3 589 700 A (CARDUNER JEAN JACQUES ET AL) 29 June 1971 (1971-06-29) figure 7	1,4-7
A	FR 2 177 784 A (KLOECKNER HUMBOLDT DEUTZ AG) 9 November 1973 (1973-11-09) page 1, paragraph 2 - paragraph 5; figures 1-3	2
A	EP 0 512 550 A (DEERE & CO) 11 November 1992 (1992-11-11) figures 4,5	2
A	US 4 758 019 A (TUCKER-PEAKE ADRIAN ET AL) 19 July 1988 (1988-07-19) figure 2	1
A	US 3 594 017 A (GROSSEAU ALBERT) 20 July 1971 (1971-07-20) figures 1,2	1
A	PATENT ABSTRACTS OF JAPAN vol. 0140, no. 26 (M-921), 18 January 1990 (1990-01-18) & JP 1 266009 A (MAZDA MOTOR CORP), 24 October 1989 (1989-10-24) abstract	1
A	US 6 435 526 B1 (KARLSSON PETER) 20 August 2002 (2002-08-20) abstract; figure 2	1

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/NO2004/000165

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6302417	B1	16-10-2001	AU 699388 B2 03-12-1998
		AU 6726696 A 12-03-1997	
		WO 9706971 A1 27-02-1997	
		BR 9610244 A 30-03-1999	
		CA 2229861 A1 27-02-1997	
		CN 1193940 A ,B 23-09-1998	
		EG 20918 A 28-06-2000	
		EP 0844935 A1 03-06-1998	
		JP 11510761 T 21-09-1999	
		ZA 9607086 A 24-02-1997	
FR 1299215	A	20-07-1962	DE 1132013 B 20-06-1962
US 2001022432	A1	20-09-2001	CA 2302842 A1 15-09-2001
US 3589700	A	29-06-1971	FR 1530587 A 28-06-1968
		OA 2813 A 15-12-1970	
		BE 715082 A 30-09-1968	
		BG 17477 A3 10-11-1973	
		CS 153011 B2 22-02-1974	
		DE 1755496 A1 30-12-1971	
		ES 353963 A1 01-02-1970	
		FR 93594 E 18-04-1969	
		FR 93830 E 23-05-1969	
		FR 94481 E 22-08-1969	
		GB 1228842 A 21-04-1971	
		NL 6806978 A 18-11-1968	
		SE 353679 B 12-02-1973	
FR 2177784	A	09-11-1973	DE 2210070 A1 06-09-1973
		DE 7208032 U 28-08-1975	
		FR 2177784 A1 09-11-1973	
EP 0512550	A	11-11-1992	DE 4115311 A1 12-11-1992
		AT 128917 T 15-10-1995	
		DE 59203949 D1 16-11-1995	
		EP 0512550 A2 11-11-1992	
US 4758019	A	19-07-1988	EP 0272259 A1 29-06-1988
		ES 2001570 A6 01-06-1988	
		WO 8701078 A1 26-02-1987	
		GB 2199547 A ,B 13-07-1988	
		JP 63502019 T 11-08-1988	
US 3594017	A	20-07-1971	BE 729823 A 18-08-1969
		DE 1915205 A1 09-10-1969	
		ES 364520 A1 16-12-1970	
		FR 1573973 A 11-07-1969	
		GB 1223366 A 24-02-1971	
		LU 58311 A1 15-07-1969	
		NL 6904876 A 30-09-1969	
		SE 357167 B 18-06-1973	
JP 1266009	A	24-10-1989	NONE
US 6435526	B1	20-08-2002	SE 518996 C2 17-12-2002
		BR 9906384 A 11-07-2000	
		DE 69918012 D1 22-07-2004	

# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/N02004/000165

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6435526	B1	EP 0991560 A1	12-04-2000
		SE 9801492 A	30-10-1999
		WO 9955576 A1	04-11-1999
<hr/>			